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ELECTRONIC CONTROL DEVICE FOR VEHICLE PNEUMATIC BRAKING PRESSURIZED AIR SUPPLY CIRCUIT

The invention shows the use of a control signal from an electronic control device (18) to block the pressurized air line (32) leading to the hand-brake valve (31) when the supply pressure in the brake pressure reservoirs (27, 27') for the pneumatic braking circuit is below that required for minimum slowing of the vehicle.

Description of the Invention

The invention relates to the use of a signal produced by an electronic control device in a motor vehicle to block a supply line leading to a hand-brake valve, and also presents a control device as well as a pressurized air production device for such a motor vehicle.

A control device of the aforementioned type is described in DE 4421575A1. A multiple-circuit protective valve with its excess power valves and a dryer is situated in the housing of this electronic pressure regulator. In the housing of the pressure regulator, a pass-through chamber is also provided for the pressurized air fed from a pressurized air source. The pass-through chamber can be connected with the atmosphere by way of a controlled outlet valve in its open position. Every overcurrent valve has a control and display unit, which branches off toward the back-pressure valve of the pressure regulator

in each case. Every control and display unit also includes a back-pressure valve that closes against the current flow direction, an activator unit for controlled opening of a pass-through valve, and a pressure sensor to record the pressure beyond the controlled back-pressure valve. In this manner a number of modes of operation are possible.

An additional pressure regulator is described in DE 3506178A1. This pressure regulator possesses a housing with an input terminal and an outlet leading to the atmosphere. A line leading to an air reservoir is usually connected, finally, to a pass-through connection. Between the pass-through chamber and the pass-through terminal there is a back-pressure valve, which opens in the direction toward the pass-through terminal and prevents a reverse current in the opposite direction. Ahead of the back-pressure valve, an outlet valve is configured, connected to a device for alternating opening and closing, which device has a magnetic valve, which is configured as a 3/2-way valve. A pressure sensor is provided that is configured as a pressure/voltage transformer and which measures the pressure following the back-pressure valve, that is, on the pass-through terminal. The output valve is configured, in the manner of a quick-release valve, with a stretched membrane. The magnetic valve is controlled by an electric switching device, in order to control the loaded operating phase and the no-load operating phase of the pressure regulator. In this manner an electronic pressure regulator is created, which fulfills the functions of the previously known mechanically constructed pressure regulator.

Patent number DE 4109741 C1 relates to a multiple-circuit protective valve for use in motor vehicles, which has a number of overflow valves with limited reverse flow, each of which is associated with one circuit. Here a division is made between circuits that are to be filled in primary and secondary priority. In the single filler line leading to the circuits with secondary priority, there is a control valve, which can be switched into a locked position or a pass-through position. The control valve is controlled depending on the opening of the two overflow valves of the primary circuits. The emphasis here, with the system intact, is on permitting safe, preferential filling of primary circuits as opposed to secondary circuits, and on making it possible to fill the air reservoirs of the circuits only when there is no defect present in either of the circuits that are to be filled primarily. For this purpose, it is possible to use a summation which can also be replaced with an electronic evaluation unit. This summation, or the

electronic evaluator unit, determines that no deficit exists in both circuits that are to be filled primarily. If this is the case, all circuits can continue to be filled. If, however, a defect is present even in just one of the primary circuits, then the secondary circuits are not filled; that is, the preferential filling of the primary circuits is maintained or continued.

It is the aim of the invention to provide a control device and/or a pressurized air production system which makes it possible, below a minimum slowing of the associated pressure in the air supply reservoirs associated with the service brake system, to prevent release of the safety brake system of the vehicle. In other words, the reservoirs of the service brake circuits should be filled only to the point where a minimum delay is possible for the vehicle to brake before the safety brake is released and the motor vehicle can be put in motion.

The invention shows the use of a control signal from an electronic control device (18) to block the pressurized air line (32) leading to the hand-brake valve (31) when the supply pressure in the brake pressure reservoirs (27, 27') for the pneumatic braking circuit is below that required for minimum slowing of the vehicle.

According to the invention, this is achieved by using a signal emitted by an electronic control device to block a supply line leading to a hand-brake valve. when the supply pressure in reservoirs associated with service brake circuits for the pneumatic braking circuit is below that required for minimum slowing of the vehicle.

The invention is based on the concept of generating, with the help of an electronic control, a signal that arises when the supply pressure in the reservoirs falls below a fixed or adjustable pressure valve of the supply pressure in the reservoirs associated with the service brake circuits. Upon the occurrence of the signal, the supply line to the hand-brake valve is blocked; that is, release of the safety brake becomes impossible so that the vehicle does not move, that is, cannot be driven away. All this occurs during the loaded operating phase of the pressure regulator, where the switching can be adjusted n such a way that the signal also only occurs when the pressure regulator happens to be in the loaded operating phase. This ensures that the reservoirs' filling procedure is continued for the individual circuits, without the vehicle being able to move. Consequently the pressurized air

pressure in the reservoirs rises. Because every reservoir is monitored in any case by a pressure scan, it can easily be determined when the pressure exceeds the described and stipulated threshold value. At this point the supply line is switched to the open-flow position so that the hand-brake valve can be activated and the parking brake can be released.

This invention can be realized, for instance, on a control device, that is, on a single system part. On the other hand, however, it can also be realized within a pressurized air production system, that is, a system that includes several different single elements, connected by corresponding electric and pneumatic supply lines.

Such a control device for pressurized a pressurized air production system for a motor vehicle is equipped with a housing which contains an input terminal, a pass-through terminal, and an outlet, and in which a pressure regulator is provided for the incoming pressurized air and can be connected with the atmosphere by a controlled outlet valve in its open position; the control device for pressurized air is also equipped with a back-pressure valve mounted after the pressure regulator and with an integrated multiple-circuit protective valve which has several control and display units which branch off toward the back-pressure valve of the pressure regulator. Also present here are a common electronic control for activating the controlled output valve of the pressure regulator and the control and display units, and, between the pressure regulator and the downstream back-pressure valves, a regeneratable dryer which is switched by means of the common electronic control and a regeneration-magnetic valve with downstream back-pressure valve for controlling the dryer. This control device, according to the invention, is distinguished in that the control and display unit associated with the hand-brake valve, in addition, includes a closed position for a supply line leading to the hand-brake valve and has a pneumatically controllable piston to reach the closed position; in that the regeneration-magnetic valve is connected by means of a control line with the control and display unit associated with the hand-brake valve; and in that the electronic control for emitting a signal when the supply pressure is too low for minimum slowing of the motor vehicle, is configured in the reservoirs associated with the service brake circuits, with which the regeneration-magnetic valve can be controlled during the loaded operating phase of the pressure regulator. Thus the invention is likewise realized in the single system part, namely the control device. The control and display unit of the

circuit with the supply line, which leads to the hand-brake valve, is configured with minor modification in comparison with the other units, so that here, in addition, a locked position becomes possible for blocking the supply line. The locked position is then assumed when, as already described, the pressure in the reservoirs associated with the service brake circuits is still too low to provide a certain minimum slowing during braking. It would therefore be too dangerous at this moment to start the motor vehicle drive process. This is prevented because the safety brake cannot yet be released by the hand-brake valve.

The control line can be connected to the line leading from the regeneration-magnetic valve to the dryer before a back-pressure valve with downstream plunger. This causes the regeneration magnetic valve to be stimulated by the generated signal, and the regeneration-magnetic valve now performs two functions. When the pressure regulator with normally filled-up reservoirs happens to be in the no-load operating phase, the regeneration-magnetic valve switches on the regeneration cycle of the dryer; that is, pressurized air is removed from the reservoirs and channeled backward by the dryer into the atmosphere, taking with it the moisture condensed in the dryer. The signal emitted by the electronic control, on the other hand, is then sent to the regeneration-magnetic valve if the pressure regulator is in the loaded operating phase and the stipulated pressure height in the reservoirs associated with the service brake circuits is not yet reached. In this case no regeneration of the dryer can take place, because the pressure regulator's loaded operating phase prevails. It is then possible, however, to use the regeneration-magnetic valve at the same time to perform a second function, namely the closed position in the supply line to the hand-brake valve.

It is possible here that an additional line runs from the control and display unit associated with the hand-brake valve and leads to a reservoir reserved for a different circuit. The control and display unit therefore has two output terminals and one input terminal. The control unit can be switched electronically as well as pneumatically. It is possible to provide a 3/2-way magnetic valve with downstream back-pressure valve for the regeneration to serve as the regeneration-magnetic valve. Such a valve can be used to serve both functions described here.

On the other hand, the invention can also be realized with a pressurized air production device of a motor vehicle with the characteristics indicated in the

generic portion of Patent Claim 6. The pressurized air production device, according to the invention, is characterized in that a locking valve, in particular a magnetic valve, can be installed in a supply line running from the control and display unit associated with the hand-brake valve to the hand-brake valve, and in that the electronic control of the control device for emitting a signal, when the supply pressure is below that required for a minimal slowing of the motor vehicle, is configured in the reservoir associated with the service brake circuits, with which the locking valve can be operated during the load-bearing phase of the pressure regulator. It is important here to install the locking valve at the correct spot on the supply line so that the hand-brake valve cannot be activated or, even if it is activated, no pressurized air can be directed from it and released.

It is possible that in the supply line leading to the hand-brake valve, a reservoir is provided for supply air, and that the locking valve in the supply line is positioned between the reservoir and the hand-brake valve. It is important here, finally, to prevent leaking of supply air from the reservoir into the hand-brake valve.

The invention is described in greater detail below with reference to preferred embodiments as seen in the drawings.

Brief Description of the Drawings

FIG. 1 shows a switching grid for a control device as a single system part in which the invention is realized.

FIG. 2 shows a switching grid of a pressurized air production device with its essential parts for the invention.

In the embodiment illustrated in FIG. 1, the elements of a pressure regulator 2, a multiple-current protection valve 3, and a dryer 4 are integrated in a common housing 1. The housing 1 with pressure regulator 2 has an input terminal 5 to which a supply line 6 leads from a compressor 7. The input terminal 5 leads to a pass-through chamber to which, on one side, a controller outlet valve 8 is connected, which leads to an outlet 9 leading to the atmosphere. The controlled outlet valve 8 has a valve body, which works with a tightened border on the housing 1 and on the other side is supported on a spring 10. A piston with a plunger is linked to the valve

body. A pressure chamber is provided for the piston, and leading to the chamber is a supply line 11 in which a 3/2-way magnetic valve 12 is situated.

A line 13 leads from the pressure regulator 2 to the dryer 4 and from there to a back-pressure valve 14 and then into a pass-through chamber not illustrated in closer detail, in which the air is distributed to the individual elements. From there a line 15 leads to a regeneration-magnetic valve 16, which also is supplied with pressurized air from the same pass-through chamber.

The regeneration-magnetic valve 16 has both of the visible switching positions and is activated through an electric line 17 by an electronic control 18. The regeneration-magnetic valve 16 possesses an aperture 19. From this, on the other side, a line 20 leads by way of a back-pressure valve 21 and a throttle valve 22 to the dryer 4. This line 20 serves to regenerate the dryer 4. The line 20 ends between the back-pressure valve 14 and the dryer 4 at the line 13.

The multiple-circuit protective valve 3 consists individually of several pressure safety valves 23, 23', 23", 23'" and pressurize sensors 24, 24', 24", 24'". An additional pressurized sensor 25 serves to stabilize the pressure immediately after the back-pressure valve 14 in the common flow-through chamber, which leads to all elements. Obviously, the pressure sensors 24 and 25 are connected with the electronic control 18. Each control and display unit 30 is made up of one pressure safety valve 23 and one pressure sensor 24. Thus an initial control and display unit 30 is provided, which is associated with the first service brake circuit. Consequently, a line 26 leads on the output side to a reservoir 27, and the pressure sensor 24 is situated in this line 26. From the line 26, a branching line 28 leads by way of a safety valve 29 into the atmosphere. In analogous manner a control and display unit is provided, which is associated with the second service brake circuit. The individual elements of this control and display unit 30' are constructed in the same way as described in connection with the control and display unit 30.

The control and display unit 30" is constructed somewhat differently. On one side it is associated with the hand-brake valve 31 and then with the parking brake system. For this purpose a line 32, in which a back-pressure

valve 33 is provided, leads to the hand-brake valve 33, and then to the spring accumulators 34 of the parking brake system. The pressure safety valve 23", associated with the control and display unit 30", possesses the three illustrated switching positions and is electrically controllable on one side. On the other side it has a pneumatic control terminal 35, which leads to a corresponding piston. This control terminal 35 is connected by a control line 36 to the line 20 issuing from the regeneration-magnetic valve 16. Thus it is possible to direct the control and display unit 30" by means of the regeneration-magnetic valve 16 and to block the supply line 32 so that activation of the hand-brake valve 31 cannot lead to the release of the parking brake system.

On the other side the control and display unit 30" is associated with yet another circuit. Consequently a line 26" leads to the reservoir 27".

The control and display unit 30'" is associated with a fourth circuit and is analogously constructed and connected. The pressurized air supplied from the compressor 7 in the loaded operating phase of the pressure regulator 2 flows to the control and display units 30, 30', 30", and 30'" by way of the back-pressure valve 14 and a line 37. From this pass-through chamber, a line 38 also branches off and carries the pressurized air supplied by the compressor 7 to the respective pressure safety valves 23, 23', 23", and 23'". The line 38 on the other side also leads to an overcurrent valve 39 and a downstream reservoir 40.

The control device depicted in FIG. 1 with its housing 1 allows the following function in connection with the connected system parts:

When the vehicle is parked and the parking brake is engaged, the spring accumulators 34 are emptied of air by the handbrake valve 31. A relatively low pressure should exist in reservoirs 27, 27', 27", and 27'" and is stabilized by the pressure sensors 24, 24', 24", and 24'", where corresponding signals reach the electronic control 18 upon the starting of the motor vehicle. Consequently the electronic control 18 switches the pressure regulator 2 into the loaded operating phase so that in normal manner the filling and raising of pressure can begin in reservoirs 27, 27', 27", and 27'". If the pressures to be stabilized by the pressure sensors 24 and 24' are too low to secure minimum slowing of the motor vehicle in a braking operation, the electronic control 18 switches the regeneration-magnetic valve 16 by the

line 17 so that pressured air can flow by the control line 36 to the control connection 35 of the control and display unit 30 and thus the position is assumed in which the supply line 32 is blocked. It is possible of course to activate the hand-brake valve 31. However, because this valve cannot provide any air to release the spring accumulators 34, the parking brake system remains engaged and the vehicle is firmly braked. This prevents the vehicle being able at this point to be moved or driven away. Activation of the regeneration-magnetic valve 16 in this phase cannot lead to regeneration of the dryer 4, because the pressure regulator 2 is in the loaded operating phase. Regeneration can only be caused if the pressure regulator 2 is in the no-load phase. Therefore the loaded phase of the pressure regulator 2 will continue until pressure is attained in the reservoirs 27 and 27' which makes possible the stipulated minimum slowing of the vehicle during possible braking. Only at this point does the electronic control switch the regeneration-magnetic valve 15 once again so that pressure is also now available on the hand-brake valve 31 by the supply line 32. Activating the hand-brake valve 31 thus leads to releasing the parking brake system. The vehicle can be moved. This is followed by an additional rise in pressure in the reservoirs 27, 27', 27", and 27'" until the foreseen maximum pressure is reached. Only then does the pressure regulator 2 switch into the no-load operating phase.

The pressurized air production system seen in FIG. 2 also has on the one hand a control device with the housing 1. This control device is of very similar construction to the control device depicted in FIG. 1. Only the control and display unit 30" is analogous in construction to the other control and display units 30, 30', and 30'". The control line 36 discontinues, and the pressure safety valve 23" has no pneumatic control terminal 35. The supply line 32 leads here to the reservoir 27" and then by a blocking valve 41 to the hand-brake valve 31. From the electronic control 18 a line 42 leads to the blocking valve 41. The blocked position of the supply line 32 therefore is not reached here by the regeneration-magnetic valve 16, but by way of a signal directed by the line 42 to the blocking valve 41. The function, however, is analogous.

Patent Claims

What's claimed is:

1. The use of a signal produced by an electronic control device (18) to block a supply line (32) leading to a hand-brake valve (31) when the supply pressure in the reservoirs (27, 27') associated with service brake circuits for the pneumatic braking circuit is below that required for minimum slowing of the vehicle

2. A control device for a pressurized air production system of a motor vehicle, with a housing (1) comprising a an input terminal (5), a pass-through terminal, and an outlet (9), in which housing a pressure regulator (2) is provided for the inflowing pressurized air and can be connected with the atmosphere by way of a controlled outlet valve (8) in its open position, with a back-pressure valve (14) positioned after the pressure regulator (2), with an integrated multiple-circuit protective valve (3), which has several control and display units (30, 30', 30", etc.), which branch off toward the back-pressure valve (14) of the pressure regulator (2), where for the activation of the controlled output valve (8) of the pressure regulator (2) of the control and display units (30, 30', etc.), a common electronic control (18) is provided, along with a regeneratable dryer (4) between the pressure regulator (2) and the downstream back-pressure valve (14), which dryer is switched by the common electronic control (18) and a regeneration-magnetic valve (16) with downstream back-pressure valve (21) for the activation of the dryer (4),
wherein the control and display unit (30") associated with the hand-brake valve (31) has, in addition, a closed position for a supply line (32) leading to the hand-brake valve (31) and possesses a pneumatically activatable piston to produce this closed position; wherein the regeneration-magnetic valve (16) is connected by a control line (36) with the control and display unit (30") associated with the hand-brake valve; and wherein the electronic control (18) is configured to generate a signal, with which the regeneration-magnetic valve (16) can be activated during the loaded operating phase of the pressure regulator (2), when the supply pressure in the reservoirs (27, 27') associated with the service brake circuits for the pneumatic braking circuit is below that required for minimum slowing of the vehicle.

3. A control device according to Claim 2, wherein the control line (36) is connected to the line leading from the regeneration-magnetic valve (16) to the dryer (4) before a back-pressure valve (21) with a downstream throttle valve (22).

4. A control device according to either of Claims 2 or 3, wherein from the control and display unit (30") associated with the hand-brake valve (31) an additional line (26") issues, which leads to a reservoir (27") intended for an additional circuit.

5. A control device according to Claim 2, wherein a 3/2-way magnetic valve with downstream back-pressure valve (21) for the regeneration is provided as a regeneration-magnetic valve (16).

6. A pressurized air production system of a motor vehicle, with a control device which has a housing (1) with an input terminal (5), a pass-through terminal, and an output (9), in which a pressure regulator (2) with downstream back-pressure valve (14) for the inflowing pressurized air is provided, which can be linked with the atmosphere by a controlled output valve (8) in open position, along with an integrated multiple-circuit protective valve (3), which includes several control and display units (30, 30', 30", etc.) which branch off toward the back-pressure valve (14) of the pressure regulator (2), where for activating the controlled output valve (8) of the pressure regulator (2) and the control and display units (30, 30', etc.) a common electronic control (18) is provided, along with, between the pressure regulator (2) and the downstream back-pressure valve (14), a regeneratable dryer (4), which is switched by the common electronic control (18) and a regeneration-magnetic valve (16) with downstream back-pressure valve (21) for the activation of the dryer (4),
wherein in a supply line (32), which leads from the control and display unit (30") associated with the hand-brake valve (31) to the hand-brake valve (31), a blocking valve (41), in particular a magnetic valve, is positioned, and wherein the electronic control (18) of the control device is configured to generate a signal with which the blocking valve (41) can be activated during the loaded operating phase of the pressure regulator (2) when the supply pressure in the brake pressure reservoirs (27, 27') for the pneumatic braking circuit is below that required for minimum slowing of the vehicle.

7. A pressurized air system according to Claim 6, wherein in the supply line (32) leading to the hand-brake valve (31) a reservoir (27") for supply air is provided, and the blocking valve (41) is situated in the supply line (32) between the reservoir (27") and the hand-brake valve (31).

Two pages of illustrations follow.